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Tables for Rapid Interpretation of Fermentation-tube Results*

(With some tables of fully computed results.)

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THERE is evidently a growing realization, not only on this continent but also abroad, that the ordinary methods of expressing results of fermentation-tube tests for B. Coli and other fermenting organisms is very unsatisfactory.

The fact that more than one fermenter from the original sample may be responsible for the gas in the positive tube, and that consequently the number of organisms in the sample is always greater than that indicated by the mere numerical proportion of positive tubes, has led to general misinterpretation of results of such tests, and to considerable confusion regarding the significance of apparent inconsistencies which often obtain therein. For example the very possible result

10 c.c. 1/3, 1 c.c. 1/3, 0.1 c.c. 1/3

may easily puzzle the analyst as well as the layman. But when interpreted into the probable number of organisms which this result really signifies, viz., 11 per 100 c.c. of sample, as given in the tables which follow, the result is clearly defined and readily understood.

But the interpretation of fermentation-tube results is not so simple a matter as is that of the agar plate count. In the latter case it is reasonably certain that each colony on the plate represents one original organism. In the former case, however, any number of organisms may be represented by the positive tube, and this difference in method of analysis entails a more elaborate method of calculating the number of organisms which this result signifies.

* From the Laboratories of the Superior Board of Health of the Province of Quebec.

This method of calculation must be based upon the principles of probability, for although we cannot see how the organisms are distributed in the sample, we know that if the sample be well mixed by shaking, certain distributions will occur with certain frequencies, whence it is possible to determine the probable number of organisms which was responsible for the tube result.

The probable number of organisms thus calculated has exactly the same significance as has the probable number of bacteria which we calculate from the count obtained from the plate count. It is not only the most accurate interpretation possible, but is also in the form which best enables us to grasp the meaning of results obtained with even the most complicated combination of tubes. And to the layman such an interpretation is perfectly intelligible, which certainly cannot be said of the ordinary method of expressing such results.

One very great advantage in such interpretation lies in the facility with which it may be applied to summarizing results obtained, for instance, from purification processes. If each day's result on a raw water, or a filtered water, for example, is given its interpretation, then at the end of the official period these numbers may be tabulated in the same form as that which has been found so satisfactory for the tabulation of plate counts, viz., the frequency tabulation similar to that proposed by the New England Waterworks Association a few years ago. This tabulation takes the following form.

Days	*Number of days that Bacteria per c.c. were*			
examined.	0-100	101-500	501-1000	etc.
31	20	7	4	

The information furnished by such a summary is certainly infinitely superior to that given by the arithmetical average (which is so frequently abused in water analytical work). There is no reason why B. Coli results may not be summarized in exactly this same form.

Such a summary of B. Coli results is well worth obtaining, even at the expense of a little more labour in using more than one tube with each dilution of sample. The present common method of employing only one tube with each dilution and striking an "index", or average, on a series of such results, has very little to commend it. Even if the average is correct (which is far from certain because of the great effect of odd chance results, even in a considerable series) this average has little meaning. It is the individual day-by-day result that tells what the plant is doing. And the above method of frequency tabulation summarizes these day-by-day results most effectively. Considering the time spent in preparing the sample, making the dilutions, etc., for the system of one tube at each dilution, the little extra time necessary to

inoculate a few more tubes in order to obtain a result which really means something should be time well spent.

Methods of Interpretation.

In any method of interpretation which is to be used in routine work one requirement must be fulfilled: simplicity of application. The formulae heretofore offered for this purpose, however simple they may have appeared to their authors who, through constant practice with them have come to know their every peculiarity, have been much too complicated for general use by men who have not the time to study them carefully. This fault the writer endeavours to correct in the present article, by offering a series of tables completely calculated for the more common systems of analysis, and a general table for calculation of any result, no matter how complicated, which eliminates all processes of multiplication and division, and so facilitates the calculation that either simple inspection or addition will yield the required probable number.

Without going into detail, it may be briefly noted that the general problem of interpretation of fermentation-tube results was considered by the writer in 1915 (1), and a general formula was proposed for all cases arising in laboratory practice.

Two years later Milton Stein (2), unfamiliar with the above work, suggested another method which, however, considered only the simpler cases. Still later Greenweed and Yule (3) (England), unfamiliar with both of these previous suggestions, offered a third series of formulae. Their treatment of the simpler cases is very complete, but their general formula is quite as formidable as that of the writer. In fact their basic formula is identical with that employed by the writer, and the only difference between the two final formulae arises out of the different approximations employed to facilitate calculation.

These three methods all give, so far as their extension permits comparison, practically identical results.

More recently Wolman and Weaver (4) have suggested a modification of the writer's original formula which eliminates some of the more laborious calculation which it involves. This original formula was written

$$(p+q)\ \log .9+(r+s)\ \log .99=\frac{p\ \log .9}{1-.9^x}+\frac{r\ \log .99}{1-.99^x}.$$

where $p+q$) = number of tubes inoculated with 10 c.c. of sample.
$(r+s)$ = number of tubes inoculated with 1 c.c. of sample.
x = number of fermenting organisms in 100 c.c. of sample.

p and r = number of tubes giving positive results, either by appearance of gas alone, or by more rigid definition depending upon isolation of a particular type of organism, according to the practice of the laboratory using the formula.

(In this formula only those terms are used which concern the particular result under consideration. If only 10 c.c. quantities of sample were inoculated into the tubes, only the first term on each side of the equation are used. If also 0.1 c.c. quantities are examined an extra similar term is added to each side in which the number .999 appears instead of .9 or .99, and so on).

Wolman and Weaver pointed out that since, approximately, log .9 = 10 log .99 = 100 log .999, etc., the formula could be written

$$100\ (p+q)+10(r+s)=\frac{100\ p}{1-.9^x}+\frac{10\ r}{1-.99^x}.$$

and the difficulty of calculation is materially reduced, especially if a slide-rule and curves are used.

This formula gives results which are fairly accurate, certainly accurate enough for practical use. But one fault still remains: the probable numbers thus obtained would not be standardized; two men would obtain different numbers; not that this difference would be of any vital significance, but to have a certain result always interpreted by the same number would be a distinct advantage for recording purposes. Then, too, the formula still involves a certain amount of calculation which to some might be objectionable.

But this suggestion led the writer to a further application of the same idea, which permits rapid calculation of tables whereby with simple processes of inspection or of addition, a standardized interpretation may be made by anyone possessing these tables.

If, instead of considering the small sample in hand, we consider the larger sample (the body of water, can of milk, etc.) from which the smaller sample was taken, the probabilities as regards the larger sample may be calculated by the same general formula as that used for the smaller sample. Suppose, for example, the larger sample is considered to contain 1,000 litres (the English authors mentioned above considered the sample to be infinite in quantity), then the formula will contain the number .99999 instead of .9, and .999999 instead of .99, and so on.

$$\text{But } \log .99999 = -.434297\times10^{-5}$$
$$\text{and } \log .999999 = -.434295\times10^{-6}$$

and since, for application to ordinary systems of analysis (even where ten tubes are employed with each dilution of sample) accuracy to four significant figures is more than sufficient, for such application Wolman

and Weaver's suggestion that one log is equal to ten times the next, etc., becomes not only an approximation, but a fact. And further, if the sample increases in size above 1,000 litres, this fact is only emphasized; as it decreases below 1,000 litres, within reasonable limits, no appreciable effect on the interpretation will be observed, as the error thus introduced is very slight. And as original samples from which smaller samples are taken are rarely much less than 1,000 litres, tables constructed on this basis will be generally applicable to all cases arising in laboratory practice.

Moreover, calculations based on an original sample of 1,000 litres (about 35 cu. ft.) should give results, when expressed in units per 100 c.c. of sample, identical with those obtained from the English formula of Greenwood and Yule, for their different assumption of an original sample of infinite volume involves differences in arithmetic so slight that they do not appear to affect the final probable numbers when expressed in units per 100 c.c. of sample, except when large numbers are carried out to an absurd degree of refinement. To have the practice on this continent uniform with that abroad is an advantage.

Use of Tables.

The Significant Part of the Result.

One general observation which applies to the use of any of the following tables is that, when a result involves more than three dilutions, only a certain group of three is significant, and the others may be discarded. To choose these three: take the highest N/N below which no M/N result occurs, and also the two following. Examples will make this rule clear (the three significant dilutions are italicized):

	10 c.c.	1 c.c.	0.1 c.c.	0.01 c.c.	0.001 c.c.
(*a*)	4/4	*4/4*	*1/4*	*0/4*	0/4
(*b*)	*2/2*	*0/3*	*1/3*	0/3	
(*c*)	*2/2*	*2/5*	*3/3*	0/3	
(*d*)	*3/3*	*0/3*	*1/3*	1/3	
(*e*)	*3/3*	*0/3*	*2/3*	0/3	

When a case such as example (*d*) arises, where a positive occurs above the three significant dilutions chosen according to the above rule, throw this positive back into the preceding dilution, making the result read as in example (*e*). (Or, if preferred, such a result may be calculated by the general Table 3, which provides for four dilutions).

TABLE 1.

This is a fully computed table of results obtained from the more common systems of analysis. As an example of its use, consider example (*f*) in the following list. From the first column of that part of the table headed "Using three tubes with each dilution" we find that two tubes positive out of three tubes, inoculated each with 10 c.c., signifies 11 fermenters per 100 c.c. of the sample.

Again, to find the meaning of the result given in example (*g*) we must use the "two tubes at each dilution" portion of the table. The third column of this portion of the table shows that this result signifies 13 B. Coli per 100 c.c. of sample.

	10 c.c.	1 c.c.	0.1 c.c.	0.01 c.c.	B. Coli in 100 c.c
(*f*)	2/3				11
(*g*)	1/2	1/2	0/2		13
(*h*)			3/5	2/5	1400
(*j*)	3/5	2/5			14
(*k*)	2/2	2/2			110+

Higher and lower sets of dilutions than those given in the table should be thrown forward or backward, and the numbers corresponding to these new results multiplied or divided by 10, 100, etc., according to the number of dilutions the result has been shifted. Thus, with example (*h*) above, throw it back two dilutions, giving the result shown in example (*j*). The table gives 14 B. Coli for this result. But the original result was thrown back two dilutions, so multiply 14 by 100, giving 1400 B. Coli per 100 c.c. of sample as the interpretation of example (*h*).

Where all the tubes are positive, as in example (*k*), we may still at least obtain a minimum probable number, for if we had used three tubes (instead of two) in the highest dilution (1 c.c. in this case) the same two tubes, at least, would have been positive, making the result read 2/2 with 10 c.c., 2/3 with 1 c.c., for which the probable number is 110 B. Coli per 100 c.c. of sample. Consequently we may say that example (*k*) means at least 110 B. Coli per 100 c.c. This expression is indicated by adding a plus sign to the numbers for cases where all the tubes examined are positive.

Where more than three dilutions enter into the result, pick out the three significant dilutions, as explained in the previous section, and enter the table with these three dilutions.

TABLE I.

Fermenting Organisms in 100 c.c. of Sample corresponding to Certain Fermentation-tube Results.

Using 2 tubes with each dilution.

Positives with 10 c.c.	No.	Positives with 10 c.c.	1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.
0	0	0	0	0	0	0	0	0
1	7	0	1	5	0	0	1	5
2	11+	0	2	10	0	1	0	5
		..	..	..	0	1	1	9
		1	0	6	0	2	0	9
		1	1	13	..	..	..	..
		1	2	20	1	0	0	6
		..	..	..	1	0	1	12
		2	0	25	1	1	0	13
		2	1	70	1	1	1	20
		2	2	110+	1	2	0	20
					1	2	1	30
					..	..	..	..
					2	0	0	25
					2	0	1	50
					2	1	0	60
					2	1	1	130
					2	1	2	200
					2	2	0	250
					2	2	1	700
					2	2	2	1100+

TABLE I—*Continued.*

Using 3 tubes with each dilution.

Positives with 10 c.c.	No.	Positives with 10 c.c.	1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.
0	0	0	0	0	0	0	0	0	2	2	1	30
1	4	0	1	3	0	0	1	3	2	2	2	35
2	11	0	2	6	0	1	0	3	2	2	3	40
3	14+	..	..	..	0	1	1	6	2	3	0	30
		1	0	4	0	2	0	6	2	3	1	35
		1	1	7	..	..	..	..	2	3	2	40
		1	2	12	1	0	0	4	..	..	..	..
		1	3	16	1	0	1	7	3	0	0	25
		..	..	..	1	0	2	11	3	0	1	40
		2	0	9	1	1	0	7	3	0	2	65
		2	1	15	1	1	1	11	3	1	0	45
		2	2	20	1	2	0	11	3	1	1	75
		2	3	30	1	2	1	15	3	1	2	115
		..	..	..	1	3	0	16	3	1	3	160
		3	0	25	..	..	..	..	3	2	0	95
		3	1	45	2	0	0	9	3	2	1	150
		3	2	110	2	0	1	14	3	2	2	200
		3	3	140+	2	0	2	20	3	2	3	300
					2	1	0	15	3	3	0	250
					2	1	1	20	3	3	1	450
					2	1	2	30	3	3	2	1100
					2	2	0	20	3	3	3	1400+

TABLE I—*Continued.*

Using 4 tubes with each dilution.

Positives with 10 c.c.	No.	Positives with 10 c.c.	1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.
0	0	0	0	0	0	0	0	0	3	0	0	11
1	3	0	1	2	0	0	1	2	3	0	1	16
2	7	0	2	5	0	0	2	5	3	0	2	20
3	14	0	3	7	0	0	3	7	3	0	3	25
4	16+	..	..	..	0	1	0	2	3	1	0	16
		1	0	3	0	1	1	5	3	1	1	20
		1	1	5	0	1	2	7	3	1	2	30
		1	2	8	0	1	3	9	3	1	3	35
		1	3	11	0	2	0	5	3	2	0	20
		1	4	14	0	2	1	7	3	2	1	30
		..	..	..	0	2	2	9	3	2	2	35
		2	0	6	0	3	0	7	3	3	0	30
		2	1	9	0	3	1	9	3	3	1	35
		2	2	13	0	4	0	9	3	3	2	40
		2	3	17	0	4	1	12	3	3	3	50
		2	4	20	..	..	..	..	3	4	0	35
		..	..	..	1	0	0	3	3	4	1	45
		3	0	11	1	0	1	5	..	..	..	..
		3	1	16	1	0	2	8	4	0	0	25
		3	2	20	1	0	3	10	4	0	1	35
		3	3	30	1	1	0	5	4	0	2	50
		3	4	35	1	1	1	8	4	0	3	70
		..	..	..	1	1	2	11	4	1	0	35
		4	0	25	1	1	3	13	4	1	1	55
		4	1	40	1	2	0	8	4	1	2	80
		4	2	70	1	2	1	11	4	1	3	110
		4	3	140	1	2	2	13	4	1	4	140
		4	4	160+	1	2	3	16	4	2	0	60
					1	3	0	11	4	2	1	95
					1	3	1	14	4	2	2	130
					1	3	2	16	4	2	3	170
					1	4	0	14	4	2	4	200
					1	4	1	17	4	3	0	115
					..	..	..	..	4	3	1	165
					2	0	0	6	4	3	2	200
					2	0	1	9	4	3	3	300
					2	0	2	12	4	3	4	350
					2	0	3	16	4	4	0	250
					2	1	0	9	4	4	1	400
					2	1	1	13	4	4	2	700
					2	1	2	16	4	4	3	1400
					2	1	3	20	4	4	4	1600+
					2	2	0	13	..	..	..	..
					2	2	1	16	..	..	..	..
					2	2	2	20	..	..	..	..
					2	3	0	17	..	..	..	..
					2	3	1	20	..	..	..	..
					2	4	0	20	..	..	..	..
					2	4	1	30	..	..	..	..

Using 5 tubes with each dilution.

Positives with 10 c.c.	No.	Positives with 10 c.c.	1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.	Positives with 10 c.c.	1 c.c.	0.1 c.c.	No.
0	0	0	0	0	0	0	0	0	3	4	0	20
1	2	0	1	2	0	0	1	2	3	4	1	25
2	5	0	2	4	0	0	2	4	3	5	0	25
3	9	0	3	6	0	1	0	2	..	..	..	..
4	16	..	..	..	0	1	1	4	4	0	0	13
5	18+	1	0	2	0	1	2	6	4	0	1	17
		1	1	4	0	2	0	4	4	0	2	20
		1	2	6	0	2	1	6	4	0	3	25
		1	3	8	0	3	0	6	4	1	0	17
		..	..	..	..	..	..	..	4	1	1	20
		2	0	5	1	0	0	2	4	1	2	25
		2	1	7	1	0	1	4	4	2	0	20
		2	2	9	1	0	2	6	4	2	1	25
		2	3	12	1	0	3	8	4	2	2	30
		..	..	..	1	1	0	4	4	3	0	25
		3	0	8	1	1	1	6	4	3	1	30
		3	1	11	1	1	2	8	4	3	2	40
		3	2	14	1	2	0	6	4	4	0	35
		3	3	18	1	2	1	8	4	4	1	40
		3	4	20	1	2	2	10	4	5	0	40
		..	..	..	1	3	0	8	4	5	1	50
		4	0	13	1	3	1	10	..	..	..	..
		4	1	17	1	4	0	11	5	0	0	25
		4	2	20	..	..	..	..	5	0	1	30
		4	3	30	2	0	0	5	5	0	2	40
		4	4	35	2	0	1	7	5	0	3	60
		4	5	40	2	0	2	9	5	0	4	75
		..	..	..	2	0	3	12	5	1	0	35
		5	0	25	2	1	0	7	5	1	1	45
		5	1	35	2	1	1	9	5	1	2	60
		5	2	50	2	1	2	12	5	1	3	85
		5	3	90	2	2	0	9	5	2	0	50
		5	4	160	2	2	1	12	5	2	1	70
		5	5	180+	2	2	2	14	5	2	2	95
					2	3	0	12	5	2	3	120
					2	3	1	14	5	2	4	150
					2	4	0	14	5	2	5	175
					..	..	..	..	5	3	0	80
					3	0	0	8	5	3	1	110
					3	0	1	11	5	3	2	140
					3	0	2	14	5	3	3	175
					3	1	0	11	5	3	4	200
					3	1	1	14	5	3	5	250
					3	1	2	17	5	4	0	130
					3	1	3	20	5	4	1	170
					3	2	0	14	5	4	2	250
					3	2	1	17	5	4	3	300
					3	2	2	20	5	4	4	350
					3	3	0	17	5	4	5	450
					3	3	1	20	5	5	0	250
									5	5	1	350
									5	5	2	600
									5	5	3	900
									5	5	4	1600
									5	5	5	1800+

NOTE—The above most probable numbers, from 0 to 20 are correct to the nearest unit. From 20 to 200 are correct to the nearest 5. Above 200 are correct to the nearest 50.

TABLE 2.

This table is similar to Table 1, but includes the cases where a 50 c.c., or a 100 c.c. portion of the sample is also tested.

Where only one number is given in the table, this is the number corresponding to the result when the large portion of sample examined is either 50 c.c. or 100 c.c. When two numbers are given, the number in parenthesis is that corresponding to the result when the large portion of sample examined is 100 c.c., and the other number is that corresponding to the result when the large portion is 50 c.c. The following examples will make this clear:

	100 c.c.	50 c.c.	10 c.c.	1 c.c.	0.1 c.c.	B. Coli in 100 c.c.
(*m*)	0/1		1/2			1
(*n*)		0/1	1/2			2
(*p*)		1/1	2/2	0/2	0/2	25
(*q*)			2/2	0/2	0/2	25
(*r*)		1/1	2/2	0/2	1/2	50
(*s*)			2/2	0/2	1/2	50

In example (*p*) above, we must choose the three significant dilutions giving example (*q*), which must be solved by Table 1. Similarly example (*r*) becomes example (*s*), and is entered in Table 1.

TABLE II.*

Fermenting Organisms in 100 c.c. of Sample.

Using 1 tube with 50 c.c. 2 " " 10 "			Using 1 tube with 50 c.c. 2 " " 10 " 2 " " 1 "				Using 1 tube with 50 c.c. 3 " " 10 "			Using 1 tube with 50 c.c. 3 " " 10 " 3 " " 1 "			
Positives with 50c.c.	10c.c.	No.	Positives with 50c.c.	10c.c.	1c.c.	No.	Positives with 50 c.c.	10 c.c.	No.	Positives with 50c.c.	10c.c.	1c.c.	No.
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	(1) 2	0	0	1	(1) 2	0	1	(1) 2	0	0	1	1
0	2	(2) 3	0	0	2	(2) 3	0	2	(2) 3	0	0	2	(2) 3
1	0	2	0	1	0	(1) 2	0	3	(3) 5	0	1	0	1
1	1	(7) 8	0	1	1	(2) 3	1	0	2	0	1	1	(2) 3
1	2	11+	0	2	0	(2) 3	1	1	(4) 5	0	1	2	(3) 4
			0	2	1	(3) 5	1	2	11	0	2	0	(2) 3
			..	..	..	..	1	3	14+	0	2	1	(3) 4
			1	0	0	2	..	..	..	0	3	0	(3) 5
			1	0	1	(5) 6	..	..	..	..	..	..	..
			1	0	2	10	..	..	..	1	0	0	2
			1	1	0	(6) 7	..	..	..	1	0	1	4
			1	1	1	13	..	..	..	1	0	2	(6) 7
			1	1	2	20	..	..	..	1	1	0	(4) 5
			1	2	0	25	..	..	..	1	1	1	(7) 8
			1	2	1	70	..	..	..	1	2	0	(9) 10
			1	2	2	110+	..	..	..	1	2	1	15
										1	2	2	20
										1	2	3	30
										1	3	0	25
										1	3	1	45
										1	3	2	110
										1	3	3	140+

TABLE II—*Continued.*

Using 1 tube with 50 c.c. 4 " " 10 "			Using 1 tube with 50 c.c. 4 " " 10 " 4 " " 1 "				Using 1 tube with 50 c.c. 5 " " 10 "			Using 1 tube with 50 c.c. 5 " " 10 " 5 " " 1 "			
Positives with 50c.c.	10c.c.	No.	Positives with 50c.c.	10c.c.	1c.c.	No.	Positives with 50 c.c.	10 c.c.	No.	Positives with 50c.c.	10c.c.	1c.c.	No.
0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	1	0	0	1	1	0	1	1	0	0	1	1
0	2	3	0	0	2	2	0	2	2	0	0	2	2
0	3	4	0	1	0	1	0	3	4	0	1	0	1
1	0	2	0	1	1	2	0	4	5	0	1	1	2
1	1	4	0	1	2	3	1	0	2	0	1	2	3
1	2	7	0	2	0	2	1	1	3	0	2	0	2
1	3	14	0	2	1	4	1	2	6	0	2	1	3
1	4	16+	0	3	0	4	1	3	9	0	2	2	4
			..	..	..	..	1	4	16	0	3	0	3
			1	0	0	2	1	5	18+	0	3	1	5
			1	0	1	3	..	..	..	0	4	0	5
			1	0	2	5	..	..	..	..	..	..	..
			1	0	3	7	..	..	..	1	0	0	1
			1	1	0	4	..	..	..	1	0	1	3
			1	1	1	6	..	..	..	1	0	2	4
			1	1	2	8	..	..	..	1	0	3	6
			1	1	3	11	..	..	..	1	1	0	3
			1	1	4	14	..	..	..	1	1	1	5
			1	2	0	7	..	..	..	1	1	2	7
			1	2	1	10	..	..	..	1	1	3	9
			1	2	2	13	..	..	..	1	2	0	5
			1	2	3	17	..	..	..	1	2	1	7
			1	2	4	20	..	..	..	1	2	2	10
			1	3	0	12	..	..	..	1	2	3	12
			1	3	1	16	..	..	..	1	3	0	8
			1	3	2	20	..	..	..	1	3	1	11
			1	3	3	30	..	..	..	1	3	2	14
			1	3	4	35	..	..	..	1	3	3	18
			1	4	0	25	..	..	..	1	3	4	20
			1	4	1	40	..	..	..	1	4	0	13
			1	4	2	70	..	..	..	1	4	1	17
			1	4	3	140	..	..	..	1	4	2	20
			1	4	4	160+	..	..	..	1	4	3	30
										1	4	4	35
										1	4	5	40
										1	5	0	25
										1	5	1	35
										1	5	2	50
										1	5	3	90
										1	5	4	160
										1	5	5	180+

*The numbers in parenthesis refer to a single tube with 100 c.c. See explanation of Table.

NOTE—The above most probable numbers, from 0 to 20 are correct to the nearest unit.

above 20 are correct to the nearest 5.

TABLE 3.

This is the general table for solution of any result. It is based on an original sample of 1000 litres, as explained before. With this size of sample the general formula becomes

$$10\,(p+q)+1(r+s)+\ldots\ldots=p\frac{10}{1-.99999^{10,000x}}+r\frac{1}{1-.999999^{10,000x}}+$$

where $(p+q)$ = number of tubes inoculated with 10 c.c. of sample.
$(r+s)$ = number of tubes inoculated with 1 c.c. of sample.
p = number of tubes positive with 10 c.c. of sample.
r = number of tubes positive with 1 c.c. of sample.

as determined either by appearance of gas alone or by more rigid definition depending on isolation of some particular type of organism.

In the table, under each value of x (B. Coli per 100 c.c. of sample) are given the values of $p\,\frac{10}{1-.99999^{10,000x}}$ and like terms, when p, r, etc. (the numbers of positive tubes) are 1, 2, 3, 4, or 5.

Therefore to solve the equation:

1. Calculate the left side of the equation by adding the products obtained by multiplying the number of tubes inoculated each with any fraction of the sample, by the number of c.c. in that fraction. Thus if five tubes are inoculated with 10 c.c., and three tubes with 1 c.c., the left side of the equation becomes 53.

$$5\times 10=50.$$
$$3\times\ 1=\ 3.$$
$$53.$$

2. Calculate the right side of the equation by guessing at the value of x (number of B. Coli per 100 c.c.) which will correspond to the result under examination; finding under this value of x the values corresponding to the number of positives and the quantity of sample inoculated into each tube, for each dilution, and adding the values so obtained.

3. This sum is compared with the other (53 in the example above) and that value of x which gives a sum nearest to this other sum is the number of B. Coli per 100 c.c. of sample.

This process may sound difficult, but the following examples will show the extreme simplicity of the method.

EXAMPLES.

Given the result -	1 c.c.	0.1 c.c.
	2/5	1/3

Left side.

$5 \times 1 = 5.$
$3 \times .1 = 0.3$

5.3

Right side.

Try 70. In table, under 70, find

1 c.c., 2 positives.....	3.973
0.1 c.c., 1 positive.....	1.479
	5.452

Try 80. In table, under 80, find

1 c.c., 2 positives.....	3.632
0.1 c.c., 1 positive.....	1.301
	4.933

But 5.452 is nearer the left hand value 5.3 than is 4.933. Therefore the probable number is 70 B. Coli per 100 c.c. of sample.

Given the result 10 c.c. 1 c.c. 0.1 c.c. 0.01 c.c.
3/3 3/3 0/3 0/3

$3 \times 10 = 30$
$3 \times 1 = 3$
$3 \times .1 = .3$
$3 \times .01 = .03$

33.33

Try 200

10	c.c., 3+	=30.
1	c.c., 3+	= 3.47
0.1	c.c., 0+	= 0
0.01	c.c., 0+	= 0
		33.47

Try 300

10	c.c., 3+	=30.
1	c.c., 3+	= 3.157
		33.157

But 33.47 is the nearer to the left hand value 33.33 so the above result means 200 B. Coli per 100 c.c. of sample. (By interpolation, since 33.33 is about midway between the two other values, the probable number of organisms is more nearly 250 per 100 c.c.).

Here again, as when using the other tables, if the result to be interpreted includes dilutions outside the range of the table, the result should be thrown backward or forward to bring it within the range of the table, and the corresponding number calculated as above, multiplied or divided by 10, 100, etc., according to the number of dilutions the result has been shifted.

Here again, also, if the result contains more than four dilutions, the most significant three or four should be chosen, and these entered in the table.

Obviously many results may be calculated simply by inspection, from the table, particularly where positives occur only in one dilution.

To save space, the table has been calculated for only five positives with each dilution. If more than five positives occur, as when six or more tubes are used with each dilution, simply add the values in the table to make up the required number of positives. Thus for seven positives, add the values for five and for two positives.

The intervals between probable numbers in this table are quite as small as warranted by the use of even more than five tubes with each dilution, so the table will give results sufficiently accurate for all cases arising in ordinary laboratory practice. And if the intervals as given in this table are employed, without interpolation, the interpretation of B. Coli results will be standardized, for all interpretations of any particular result will be identical.

There is no doubt that, were all B. Coli results expressed by stating both the laboratory result (to indicate the precision of the system employed), and the number of organisms which this result signifies (as calculated by the methods given above), a considerable advance in the utility of the B. Coli test would be gained.

Continuation of Table 3,

For the sake of completeness, the values for the dilution 50 c.c. are appended. These values are to be used in connection with those of Table 3, when 50 c.c. portions of the sample are also tested.

Dilution 50 c.c., 1 positive.

	Organisms per 100 c.c.		*Organisms per 100 c.c.*
1	127.075	11	50.205
2	79.099	12	50.125
3	64.361	13	50.076
4	57.826	14	50.046
5	54.472	15	50.028
6	52.620	16	50.017
7	51.557	17	50.010
8	50.933	18	50.006
9	50.562	19	50.004
10	50.339	20	50.002
		Over 20	50.000

References:

(1) Jour. Inf. Diseases, Vol. 17, No. 1.
(2) Eng. News-Record, Vol. 78, No. 8.
(3) Jour. Hygiene, July, 1917.
(4) Jour. Inf. Diseases, Vol. 21, No. 3.

TABLE III.

Number of Organisms per 100 c.c.

Dilution.	Number of Positives.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1	105.08	55.167	38.583	30.332	25.415	22.164	19.864	18.160	16.851	15.820	14.990	14.311	13.746	13.273	12.872
	2	210.17	110.33	77.166	60.665	50.830	44.327	39.729	36.319	33.702	31.640	29.979	28.621	27.493	26.546	25.744
10 c.c.	3	315.25	165.50	115.75	90.997	76.245	66.491	59.593	54.479	50.254	47.459	44.969	42.932	41.239	39.819	38.617
	4	420.34	220.67	154.33	121.33	101.66	88.655	79.457	72.639	67.405	63.279	59.958	57.242	54.985	53.092	51.489
	5	525.42	275.83	192.91	151.66	127.08	110.82	99.322	90.799	84.256	79.099	74.948	71.553	68.732	66.366	64.361
	1	100.50	50.500	33.836	25.503	20.504	17.172	14.792	13.007	11.619	10.508	9.600	8.843	8.203	7.655	7.179
	2	201.01	101.00	67.673	51.006	41.009	34.343	29.583	26.013	23.237	21.017	19.200	17.687	16.406	15.309	14.359
1 c.c.	3	301.51	151.50	101.51	76.509	61.513	51.515	44.375	39.020	34.856	31.525	28.800	26.530	24.610	22.964	21.538
	4	402.01	202.00	135.35	102.01	82.018	68.686	59.166	52.026	46.474	42.034	38.400	35.373	32.813	30.618	28.717
	5	502.52	252.50	169.18	127.52	102.52	85.858	73.958	65.033	58.093	52.542	48.000	44.217	41.016	38.273	35.896
										11.161	10.050	9.141	8.384	7.742	7.193	
	1	100.	50.050	33.378	25.050	20.052	16.717	14.335	12.550							6.717
	2	200.	100.10	66.756	50.100	40.104	33.434	28.670	25.100	22.321	20.101	18.282	16.767	15.485	14.385	13.434
$\frac{1}{10}$ c.c.	3	300.	150.15	100.13	75.150	60.156	50.150	43.005	37.649	33.482	30.151	27.422	25.151	23.227	21.578	20.150
	4	400.	200.20	133.51	100.20	80.208	66.867	57.340	50.199	44.643	40.201	36.563	33.535	30.969	28.771	26.867
	5	500.	250.25	166.89	125.25	100.26	83.584	71.675	62.749	55.804	50.252	45.704	41.918	38.712	35.963	33.584
	1	100.	50.	33.333	25.	20.	16.667	14.286	12.5	11.111	10.	9.091	8.333	7.692	7.143	6.671
	2	200.	100.	66.666	50.	40.	33.333	28.571	25.0	22.222	20.	18.182	16.667	15.385	14.286	13.342
$\frac{1}{100}$ c.c.	3	300.	150.	99.999	75.	60.	50.000	42.857	37.5	33.333	30.	27.273	25.000	23.077	21.429	20.013
	4	400.	200.	133.33	100.	80.	66.667	57.143	50.0	44.444	40.	36.364	33.333	30.769	28.571	26.684
	5	500.	250.	166.67	125.	100.	83.333	71.429	62.5	55.556	50.	45.455	41.667	38.462	35.714	33.356

TABLE III—*Continued.*

Dilution.	Number of Positives.	16	17	18	19	20	30	40	50	60	70	80	90	100	110	120
	1	12.530	12.235	11.980	11.759	11.565	10.524	10.187	10.068	10.025	10.009	10.003	10.001	10.000	10.	10.
	2	25.059	24.470	23.961	23.517	23.130	21.048	20.373⅓	20.136	20.050	20.018	20.007	20.002	20.001	20.	20.
10 c.c.	3	37.589	36.706	35.941	35.276	34.696	31.572	30.560	30.203	30.075	30.027	30.010	30.004	30.001	30.001	30.
	4	50.119	48.941	47.921	47.035	46.261	42.096	40.746	40 271	40.100	40.036	40.013	40.005	40.002	40.001	40.
	5	62.649	61.176	59.902	58.794	57.826	52.620	50.933	50.339	50.125	50.046	50.017	50.006	50.002	50.001	50.
	1	6.763	6.397	6.071	5.779	5.517	3.858	3.033	2.542	2.216	1.986	1.816	1.685	1.582	1.499	1.431
	2	13.527	12.793	12.141	11.558	11.033	7.717	6.066	5.083	4.433	3.973	3.632	3.370	3.164	2.998	2.862
1 c.c.	3	20.290	19.190	18.212	17.337	16.550	11.575	9.100	7.625	6.649	5.959	5.448	5.025	4.746	4.497	4.293
	4	27.053	25.586	24.282	23.116	22.067	15.433	12.133	10.166	8.865	7.946	7.264	6.710	6.328	5.996	5.724
	5	33.817	31.983	30.353	28.895	27.583	19.291	15.166	12.708	11.082	9.932	9.080	8.426	7.910	7.495	7.155
	1	6.3	5.933	5.606	5.313	5.05	3.384	2.550	2.050	1.717	1.479	1.301	1.162	1.051	0.960	0.884
	2	12.6	11.865	11.211	10.626	10.10	6.767	5.101	4.101	3.434	2.958	2.601	2.324	2.102	1.920	1.769
$\frac{1}{10}$ c.c.	3	18.9	17.798	16.817	15.940	15.15	10.151	7.651	6.151	5.151	4.437	3.902	3.486	3.153	2.880	2.653
	4	25.2	23.730	22.423	21.253	20.20	13.535	10.201	8.202	6.869	5.917	5.203	4.647	4.203	3.840	3.537
	5	31.5	29.663	28.028	26.566	25.25	16.918	12.752	10.252	8.586	7.396	6.503	5.809	5.254	4.800	4.422
	1	6.254	5.889	5.562	5.269	5.005	3.338	2.505	2.005	1.672	1.433	1.255	1.116	1.005	0.914	0.838
	2	12.508	11.779	11.123	10.538	10.010	6.676	5.010	4.010	3.343	2.867	2.510	2.232	2.010	1.828	1.677
$\frac{1}{100}$ c.c.	3	18.762	17.668	16.685	15.806	15.015	10.013	7.515	6.016	5.015	4.300	3.765	3.348	3.015	2.742	2.515
	4	25.016	23.557	22.247	21.075	20.020	13.351	10.020	8.021	6.687	5.734	5.020	4.464	4.020	3.656	3.353
	5	31.270	29.446	27.809	26.344	25.025	16.689	12.525	10.026	8.358	7.167	6.275	5.580	5.025	4.570	4.192

TABLE III—*Continued.*

Dilution.	Number of Positives.	130	140	150	160	170	180	190	200	300	400	500	600	700	800	900
	1	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
	2	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
10 c.c.	3	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
	4	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.
	5	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
	1	1.375	1.327	1.287	1.253	1.224	1.198	1.176	1.157	1.052	1.019	1.007	1.002	1.001	1.000	1.000
	2	2.749	2.655	2.574	2.506	2.447	2.396	2.352	2.313	2.105	2.037	2.104	2.005	2.002	2.001	2.000
1 c.c.	3	4.124	3.982	3.862	3.759	3.671	3.594	3.528	3.470	3.157	3.056	3.020	3.007	3.003	3.001	3.000
	4	5.499	5.309	5.149	5.012	4.894	4.792	4.703	4.626	4.210	4.075	4.027	4.010	4.004	4.001	4.000
	5	6.873	6.637	6.436	6.265	6.118	5.990	5.879	5.783	5.262	5.093	5.034	5.012	5.005	5.002	5.001
	1	0.820	0.765	0.718	0.676	0.640	0.607	0.578	0.552	0.386	0.303	0.254	0.224	.199	.182	.169
	2	1.641	1.531	1.436	1.353	1.279	1.214	1.156	1.103	0.772	0.607	0.508	0.449	.397	.363	.337
$\frac{1}{10}$ c.c.	3	2.461	2.296	2.154	2.029	1.919	1.821	1.734	1.655	1.157	0.910	0.762	0.673	.596	.545	.503
	4	3.281	3.062	2.872	2.705	2.559	2.428	2.312	2.207	1.543	1.213	1.017	0.898	.795	.726	.671
	5	4.102	3.827	3.590	3.382	3.198	3.035	2.889	2.758	1.929	1.517	1.271	1.122	.993	.908	.843
	1	0.774	0.719	0.672	0.630	0.593	0.561	0.531	0.505	0.338	0.255	0.205	0.175	.148	.130	.116
	2	1.548	1.439	1.343	1.260	1.187	1.121	1.063	1.010	0.677	0.510	0.410	0.349	.296	.260	.232
$\frac{1}{100}$ c.c.	3	2.323	2.158	2.015	1.890	1.780	1.682	1.594	1.515	1.015	0.765	0.615	0.524	.444	.390	.349
	4	3.097	2.877	2.687	2.520	2.373	2.242	2.125	2.020	1.353	1.020	0.820	0.698	.592	.520	.465
	5	3.871	3.596	3.358	3.150	2.966	2.803	2.657	2.525	1.692	1.275	1.025	0.873	.740	.650	.581

TABLE III—*Continued.*

Dilution.	Number of Positives.	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	3000	4000	5000	6000
10 c.c.	1	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.	10.
	2	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
	3	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
	4	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.	40.
	5	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
1 c.c.	1	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
	2	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.
	3	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.	3.
	4	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
	5	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
$\frac{1}{10}$ c.c.	1	.158	.150	.143	.137	.133	.128	.125	.122	.120	.118	.116	.105	.102	.101	.100
	2	.316	.300	.286	.275	.265	.257	.251	.245	.240	.235	.231	.210	.204	.201	.201
	3	.475	.450	.429	.412	.398	.386	.376	.367	.359	.353	.347	.316	.306	.302	.301
	4	.633	.600	.572	.550	.531	.515	.501	.489	.479	.470	.463	.421	.407	.403	.401
	5	.791	.749	.716	.687	.664	.644	.626	.612	.599	.588	.578	.526	.509	.503	.501
$\frac{1}{100}$ c.c.	1	.105	.096	.088	.082	.077	.072	.067	.064	.061	.058	.055	.039	.030	.025	.022
	2	.210	.192	.177	.164	.153	.144	.135	.128	.121	.116	.110	.077	.061	.051	.044
	3	.315	.288	.265	.246	.230	.215	.203	.192	.182	.173	.166	.116	.091	.076	.066
	4	.420	.384	.354	.328	.306	.287	.271	.256	.243	.231	.221	.154	.121	.102	.089
	5	.525	.480	.442	.410	.383	.359	.338	.320	.304	.289	.276	.193	.152	.127	.111

"Tuberculosis and Maternity"

Reprinted from the 1918 Annual Report of the Canadian Association for the Prevention of Tuberculosis.

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I AM sure that to those who attend a gathering such as this, the fundamental facts with regard to tuberculosis are familiar, however wrong and even ridiculous may be the ideas of the general public. Yet it may not be out of place even here in seeking to discuss a certain theorem, to state again some postulates and axioms on which our reasonings are based, some facts already established. Briefly a few such may thus be stated:

1. Tuberculosis is not inherited. It is acquired not before, but after, birth, not in the process of gestation but by post-natal contact.

2. Tuberculous infection is acquired easily and commonly by young children; with difficulty and seldom by adults.

3. Infection in ordinary communities is practically universal.

4. Mid-life, is not a time of new infections, but a time of break-down to old infections which have been lying more or less latent since childhood. It is the time of breakdown because it is the time of fullest work, of most strenuous endeavour, of overstrain, of dissipation, of spending without counting the cost, the time of child-bearing and child-rearing.

It follows that when an adult becomes ill with tuberculosis, it is comparatively useless to enquire for the source of infection: the real line of enquiry is as to what caused the break-down. The tubercle bacillus, which may have lain harmlessly in the tissues for years, is, after all, only the remote cause of the disease: the real cause is the debilitating condition which gave the bacillus an opportunity.

Soldiers become tuberculous in barracks and in the trenches, not because infected there, but because broken down there by adverse conditions.

"Break-down" is the word. Not sources of infection half so much as causes of break-down must be searched out and stopped if tuberculosis is to be kept from slaying its thousands and tens of thousands.

That maternity has a part in the etiology of tuberculosis, and is apparently responsible for certain cases of tuberculosis break-down, has frequently been shown. Bacon, of Chicago, estimated in 1912 that in the United States at any one time 32,000 tuberculous women were

pregnant. If so, then possibly 3,000 pregnancies occur each year in women with active tuberculosis in Canada.

Among 1,100 tuberculous mothers reported on by Fishberg, Funk, Jacob and Parnwitz, 39% believed their active symptoms originated during pregnancy or the puerperium.

This paper is based on the records of the Manitoba Sanatorium. Of 1,900 patients treated in the past seven years, 350 were married women. Eliminating the histories of those who had no children, those whose maternal history is not fully recorded, and a few in whom the diagnosis of tuberculosis was negatived or could not be definitely established, there remain for consideration 200 undoubted cases of tuberculosis with maternal histories fairly adequately recorded.

The Manitoba Sanatorium, like most others, began with the idea of treating ambulant cases only, but has been compelled increasingly to make provision for hospital as well as sanatorium care, so an increasing proportion of the cases admitted during the seven years were far advanced.

Since our investigation did not extend to women of normal health, we realize that definite conclusions are not warranted. Statistics to be of value must be tested by wide comparisons. Still, any consideration of 200 cases must yield some facts, and form certain opinions which can be put forth with a degree of confidence.

The 200 women under consideration were classed by the regular standards as: Incipient, A or B, 8%; moderately advanced, A or B, 16%; and far advanced, A, B or C, 76%.

Included in the class far advanced were 32 or 16% of the whole who were on admission classified as "apparently hopeless". Roughly the whole 200 were 20% farther advanced than the average of 1,900 patients. resorted to, may be not so much a physical as a social result of maternity.

Such a regrettable far advanced condition before definite treatment is Mothers get away from home for treatment late. When a man's earning capacity is impaired, when he cannot do his full day's work, he is usually willing to consider going away from home for definite treatment, but long after a mother has reached that stage she can still attempt to do her work or at least direct it, and when unable to do even that is still loath to leave her children.

With a far advanced percentage of 76 including an apparently hopeless percentage of 16, no brilliant results of treatment could be looked for. Of the 200, 11% died in the Sanatorium; 28.5% have since died; 8% are known to be doing badly; 28% to be doing well, and the remainder, 24.5% have been more or less lost track of.

The results are so definitely worse than the average that there may be a fair presumption of specific lack of resistance in tuberculous mothers.

No part of the problem presented by a tuberculous person is more interesting, or more difficult than that of determining, or trying to determine, the date of onset of the disease. This can be arrived at only after a careful study of ups and downs of health from childhood, of minor and major ailments, of recurring "colds", "grippes", attacks of bronchitis, slight pleurisies, of run-down or nervous conditions, of periods of indigestion or losses of weight or strength, which, in view of a present positive diagnosis can sometimes all be strung on one string. In the 200 cases under consideration there was a definite history of break-down from tuberculosis before marriage or maternity in 14% of the series; presumed previous disease in 10%; suspected previous disease in 19% and no evidence to indicate pre-maternal disease in 57%.

It might not be far from the mark to estimate one-third as probably pretty definitely tuberculous, with or without diagnosis, before maternity.

When a woman has broken down definitely before marriage, then after arrest of the disease and marriage has again broken down during child-bearing, the dates of both the pre-maternal and the post-maternal break-downs merit consideration. In our series the earlier or pre-maternal break-down averaged ten years before admission and the later or post-maternal breakdown slightly less than one year before admission.

In those cases in which no pre-maternal break-down could be made out, the duration of disease at the time of admission averaged nearly two years. It would seem then, that a break-down coming at the time of pregnancy or child birth is more rapid in the case of a woman previously tuberculous.

It has been frequently said that a tuberculous woman may bear the first pregnancy and child birth well, the second not so well, and the third not at all. Of those with definite or presumed pre-maternal break-down, 41% had one child only, 24% two, 17% three, and 19% more than three. Since most of these women broke down definitely at the time of, and presumably on account of, child bearing, it may rather be said that of tuberculous women, 41% do not bear even the first child birth; 24% fall down in the second, 17% in the third, while 19% get beyond the third.

Of the whole 200, including those with definite pre-maternal break-down, 27% broke down after the first child birth, 28% after the second, 24% after the third, and 21% after the fourth and later child births.

The break-downs at the first child births are twice as numerous in those with positive pre-maternal disease as in those in whom previous break-downs cannot be made out. Break-down occurred in the latter one child birth later than in the former.

Twin births do not appear to have been significant, but the care of twin children through the period of lactation and later seems to have

been, as would be expected, a definite cause of debility, and therefore of disease.

Break-down occurred unequally at the different parts of the child-bearing cycle. Leaving out of account four cases in which it occurred before the first pregnancy and 32 considerably after the last lactation, there remain for consideration 164 cases of definite break-down within the cycle.

Of these it occurred during pregnancy—chiefly in the latter part—in 25%, in child-birth at full term or miscarriages, and in the puerperium in 24%, during lactation in 36%, and in the interval between the end of lactation and the beginning of the next pregnancy in 15%. Considering the duration of pregnancy as, roughly, nine months, the puerperium one month, lactation a year, and the average waiting period 15 to 18 months, the puerperium had, comparatively, much the greatest proportion of break-downs—24% per month, lactation and pregnancy about 3% per month and the interval one per cent per month.

The latter half of the period of pregnancy would seem to be much more fraught with danger than the earlier months.

It would seem from the data covered that an accidental miscarriage is more dangerous and much more definitely predisposes to break-down than an ordinary child birth.

Of the 32 in whom the break-down occurred at the considerable period after the last lactation, a fairly large proportion were cases in which women after bearing fairly large families, sometimes under hard living conditions, broke down near the menopause.

A record was made of the size of families and the intervals between births. Without stating percentages, a connection can be presumed, and easily believed, to exist, between multiple pregnancies at short intervals, with consequent exhaustion, and tuberculosis break-down.

The ages of the mothers at the beginning of child bearing were recorded. Ten per cent. were 18 years and under, and 36% in all 21 years of age and under, when the first child was born. No conclusion could be drawn without considering ages at the beginning of maternity in a large number of normal women; but the impression made by many histories was that very early pregnancy was a definite element in break-down.

A bad family history was reported in 36 cases or 18%, but seemed of no very special significance.

Of the 200, 71.5% were considered to be of the usual catarrhal type, 17.5% pleuritic, 6% pneumonic, and 5% hemorrhagic. In an almost equal number of tuberculous soldiers, the percentage of pleuritic type was about twice as great.

The proportion of acute onsets was large.

The various complications seem to have been not much more frequent than in ordinary cases at the same advanced stages. It may, I think, be noted, and has been observed in other series, that a tuberculous larynx, always serious as a complication, seems to be even more so in women who have been, or are, pregnant. Of 31 with marked disease of the larynx, only six are now living.

Bacilli were found in the sputum of 148 out of the 200, or in 74%, a higher percentage than the Sanatorium average, but quite in keeping with the farther-advanced-than-average conditions of these cases.

Natural physique was recorded as good in 25%, fair in 45% and poor in 30%, quite likely a little lower than the general community average.

Living conditions made up of such elements as housing, kind and amount of work, were reported good, fair, and bad, in what would seem to be about the average community proportion. Some individual histories showed very bad conditions indeed, especially after the care of young children was added to other duties.

No history is exactly like any other or made up of exactly similar elements. It is hard to value the significant elements in their true proportions. In the complex life of a busy housewife and mother, it is difficult to say just which elements most definitely have contributed to break-down. Bad living conditions are all too common in homes both rural and urban, while hard work, child bearing and child care form almost a vicious circle.

After all allowances have been made however, the conclusion cannot well be avoided that child bearing has a definite place in the etiology of tuberculosis. It can, on the one hand, break down resistance and cause a flare up of old pre-maternal disease; and on the other hand, added to other burdens, it can definitely cause initial break-down in one who has not before shown evidence of the disease.

This is not by any means strange, but only what might be expected after considering all that child bearing means. It means during pregnancy an added strain upon every function of the body—certainly on the nervous organization, just as certainly on the organs of elimination, especially the kidneys, and on the digestive apparatus. It means, usually, impaired appetite and vomiting, and in the later months an actual physical burden which is not inconsiderable. By women in an ordinary position in life, these additional burdens must be borne while all ordinary household duties must still be performed. Pregnancy, therefore, for most women, adds to existing burdens another heavy burden.

The actual delivery means pain, intra-abdominal pressure which puts strain also in thoracic viscera, an amount of shock comparable with that of a surgical operation, altered position of viscera, possibly laceration, sometimes considerable loss of blood.

Even if the mother does not nurse the infant, the birth of a child into the home doubles work and is certain to cut down rest as well. The mother, who is nurse and housekeeper too, is tied down to a very rigid routine, and deprived of the change and rest for which she now has special need. The modern care of a child is more exacting and time-consuming than the more haphazard care of earlier generations. It must be remembered also that a child born of a somewhat weakened mother needs extra attention.

To believe that such a degree of strain and stress, so great a disarrangement of habit, such continued loss of rest, may break down a tuberculous woman, or, added to other burdens, break down one so far non-tuberculous, it is not necessary to believe that child-birth gives any special or specific predisposition to tuberculosis. The *quantity* of the strain, it may be, quite as much as the *kind* of strain, counts. A woman of normal health and strength may be able on a certain day to double her burden of work and carry the doubled burden without break-down; one with patched up old tuberculosis will not unlikely be broken down by such a change; and one, even non-tuberculous, who already has all the burdens she can bear will likely also be broken down by the increase even though the new burdens should be of the same kind as the old.

A tuberculosis break-down before maternity means that the ordinary routine of an ordinary unmarried woman under ordinary conditions has involved an expenditure of energy beyond what she could afford. Would it seem likely that such a one would be able to afford the extra expenditure involved in pregnancy, child-birth, lactation and child-care? If a man breaks down in the workshop, what is the use of sending him to the trenches?

A very fair rule of life for one who has tuberculosis, and also for one who has not, and does not wish to have, is the plain common sense rule of keeping energy expenditure well within energy income. Constant spending beyond income can result only in depleted capital and mortgaged resources; careful expenditure within income means financial safety.

Child-birth and all that goes with it is dangerous when it represents an expenditure *beyond income*: then it leads to health bankruptcy. For a woman who already has a definite history of tuberculosis, that is one carrying a mortgage, child-bearing is a very risky speculation. If it is ever to be considered, all resources must first be investigated, the cost must be counted, the reckoning made up beforehand.

Should a woman known to be, or to have been, actively tuberculous ever risk maternity? Like most large questions this cannot be answered categorically. Even normal maternity is not altogether without danger, but always means sacrifice, and many women who are tuberculous will demand motherhood even if their danger and their sacrifice are to be beyond the usual. Where should the line be drawn?

Pregnancy should not be allowed in a woman who has *ever* reached the *anatomical* far-advanced stage, or ever had far-advanced *symptoms*. It should never be allowed in the presence of active symptoms, however slight, or connected with however slight a lesion. It should never be allowed until the disease has been quiescent and sputum free from bacilli for at least three years.

If, when the disease was active, the lesion was small or moderate in extent, the symptoms moderate or slight; if the course was in every respect favourable, the arrest definite; if there has been freedom from symptoms for from three to five years; if, during that interval, strength and resistance have been well tried out at ordinary work with no evidence of weakening or break-down; if at the same time living conditions are good; if it is possible during practically the whole period of pregnancy and child-care to have, if necessity should arise, release from other burdens, and if there can be experienced supervision of the mother during the whole period, pregnancy can be allowed in a tuberculous woman with some confidence that it will not lead to a break-down.

There is a fairly common idea, found sometimes even among medical men, that pregnancy even improves the condition of a tuberculous woman. It is said that in the earlier months, the condition does apparently improve; but this is not so true of the later months when the tendency is distinctly toward set-back. An improved appearance may mask advancing disease. Bacon says the first three months of pregnancy are favourable for a tuberculous woman, the second three months not so favourable, and the third three months bad.

When pregnancy has begun in one whose disease is advanced or active, definite increase in symptoms should not be waited for. Pregnancy should be terminated without delay. And when in one with apparently quiescent disease and apparently able for the strain of child-bearing, any freshening up of signs of disease occurs early in pregnancy, no time should be lost. Termination of pregnancy in the earlier months gives better results than allowing gestation to proceed. It should not be attempted after the 5th month.

Should pregnancy be allowed to proceed, labour should be induced a little before term, and forceps and anaesthetic used to make labour as easy as possible.

A tuberculous mother should under no circumstances nurse her child, partly because of danger to the child, but just as definitely because of the great danger to herself.

So far, the conclusions, which possibly were almost self-evident to begin with, have applied to women known to be tuberculous. They apply, in proportion, to the definiteness of the suspicion, also to any who are under suspicion of tuberculous disease. Until suspicion has cleared

up pregnancy should be definitely advised against. The same advice should be given to any who are in the unscientifically named but rather definite class known as "pretuberculous", and indeed to any woman in an unsatisfactory condition of health from causes other than tuberculosis. So far then, the moral might be stated. "Except in very rare cases, prevent Tuberculous women from bearing children". A moral of wider application and even greater importance, I take it, is: "Prevent a child-bearing woman from becoming Tuberculous." Tuberculosis among soldiers we understand. Young men subjected to the hard life of barracks or camp, or to the desperate toil of the trenches, develop unsuspected weaknesses, stir up latent disease which might never have become evident in a long life at home. Under moderate strain they remain healthy, but excessive strain breaks them down. They carry to the War latent tuberculosis and bring back active tuberculosis.

Maternity is a physiological function and not a monster like war. But it is a trying-out time for women, a time when the unfit break down. The strain of child-birth may not have been enough recognized. The child-bearing woman may not have been enough safeguarded. This extra burden may not have been well enough provided for. Under ordinary conditions where the woman is the housewife, perhaps with duties even outside the home, with one child scarcely on its feet before another is in the mother's arms, with bad housing and perhaps some special cause of worry or discouragement, with the care of fretful and sick children,—is it difficult to understand a breaking down of resistance and a lighting up of even a deeply furied focus (such as may almost be considered universal) into active disease?

Dr. Bacon of Chicago has argued well for special institutions for the reception and care of tuberculous women who are becoming mothers—special sanatorium maternity homes,—and these, it would seem, should be a part of the equipment of at least the larger communities.

It is right that the most adequate care should be given to our soldiers, broken down by the stress of war. It is just as right that the best possible care should be provided for the mothers broken down or in danger of being broken down by the stress of child-bearing and child-care.

But it is not institutions and not legislation that can be chiefly counted upon to lessen the inroads of tuberculosis. In season and out of season the people, and all the people, must be taught. And one central truth of our teaching, which should become a mode of thought with doctors, nurses, clergymen, teachers, social workers, parents, all leaders, is that after early adult life has been reached the cause of tuberculosis is not the tubercle bacillus but *overstrain*. An intelligent application of this truth would safeguard the health and life of many an over-burdened child-bearing woman.

The Social Background

Sex Education? By Whom?

MATTIE LOUISE FOSTER.

MUCH that is being said, and more that is being unsaid and undone, indicates a widespread fear of the strength of the sex—impulse. Social workers are baffled by it, the Churches, Schools, Christian Associations, Hebrew Associations, etc., all avoid the supervision of mixed gatherings of young people. Yet all these workers know that it is both natural and inevitable that the young people of the opposite sexes should seek each other's society, indeed that mating romance is perhaps the most powerful interest of youth. We provide opportunity and leadership in athletics, and develop strong, healthy bodies. We provide opportunity and leadership in mental development, and try to direct the ambitions of youth in order that they may be self-supporting builders in the industrial community. But we leave the fundamental social impulse to find its instruction by indirection, its opportunity to chance, its leadership in blind custom.

The danger of ignorance concerning the sex-life needs no emphasis to the social worker. The heads of Rescue Homes will tell you that though feeblemindedness and low wages each have a part in the whole, in many sad stories ignorance is the greatest factor. Yet we still find in wholesome normal society, mothers of young daughters, who believe that ignorance, "innocence" is the best protection. A daughter shielded in a happy home will reach womanhood unharmed in body, but seldom unharmed in mind. The sex-tragedies related in the daily press, the hints, and more than hints conveyed in poem, drama, and current fiction, the stray bits of gossip she picks up even in her own school and social circles, give such a girl fearful, shuddery glimpses of the ravages of ill-directed sex-forces, and nothing at all is done to teach her how these same forces are powerful builders of her body, her mind, her home, her society, her country. Such a girl usually enters into marriage deterred by her fears of the unknown, thinking, as one novelist puts it, of her first sex experience "as the great white sacrifice". Among boys, where curosity is more frankly expressed, it is equally true that what little real information they possess is tainted, with filth at its source, and mixed with pitiful misinformation. Such a lad may learn self-control in sex for shame's sake, but may keep sexual integrity through fear of the consequences of vice—but are these the highest or safest

foundations for a clean life? Should we not overcome evil with *good* rather than with fear of punishment?

Freud, in his remarkable study of dreams finds sex-factors almost always present, active in the sub-conscious, because repressed in our conscious life. He says that sex is one of the strongest natural impulses, the one subjected to the greatest repression, and for that reason the weakest point in our cultural development. It would seem that Paul's advice to "know the truth and the truth shall make you free" has another application. Misinformation, fear, the superstition that sex is a subject taboo, has for generations poisoned passion, and made marriage itself too often brutal and unclean.

If we believe that sex education is necessary then the question immediately arises, "When shall it be given?"; "By whom?"; "How"? It is possible that birthdays provide suitable occasions when little by little, as a special confidence, and in advance of the immediate needs information might be imparted. If these truths are to be communicated by parents, are they competent? Blessed is that boy whose father has anticipated the education of the playground and the back lane, and has taught his son the simple facts of sex, and given him some vision of ideal manhood and fatherhood. Blessed is the girl whose mother has shown her that her body is a sacred thing and that sex is a great potential source of grace and charm and the conserver of life itself. Such youths know a real reason for their chastity, and such knowledge is pitifully rare. "She knew she had done wrong or she would not have hidden it." I protest No. Your puppy will sneak and hide if he has chewed up your slipper, not because he has a property sense, and knows he has done wrong, but because he has learned that he may get his ears boxed. Figuratively, most parents box the ears of childish curiosity, and stand adolescent love in the corner, instead of satisfying the one and idealising the other.

If parents are willing and capable of imparting sex knowledge they are the ideal teachers. But they are usually very reluctant to do so, not so much because they disapprove as because they realize their inability. They may not know all the physical facts. Themselves untaught, they do not know how to impart the facts, nor have those facts ever been given their larger social and spiritual interpretations. Is not here an opportunity for social service? Could not doctors, nurses, and other well-qualified leaders teach parents? Could not adult Sunday school classes, home and school clubs, men's clubs and women's clubs seek sound instruction and learn how and what to teach their growing sons and daughters? How gladly, reverently, and wholesomely the young folk will receive this knowledge from the lips of those they have already learned to respect, I can testify as can many another.

The Present Social Outlook

F. N. STAPLEFORD, M.A.

IN the report of the Committee on Neighbourhood Work, presented at the last meeting of the Canadian Conference of Charities and Correction, (now to be known as the "Canadian Conference on Public Welfare"), the following passage occurs:

"A further handicap under which the committee has suffered is the fact that there exists as yet, very little understanding of the meaning of community life. We are at present in a stage of exaggerated individualism; the consciousness of our essential mutual interdependence has not dawned upon us. We do not at the present time realize the fundamental truth of the statement that "we are all members one of another". Therefore, though there is a considerable social activity, it is for the most part directed toward individuals, and there is very little conception of the possibility of dealing with the problems of the community as a whole . . . . if therefore we wish to secure a sound political and social life in our country, we must turn our attention seriously to the development of community consciousness on the part of our citizens."

Is this an accurate diagnosis of the present situation? That it would have been a fair characterization of the Canadian situation up to a very recent time very few would care to question. That individualistic philosophy which flourished so mightily in Great Britain fifty years ago, but which has now largely been displaced there, seemed to find a congenial atmosphere and a lengthened vigour in Canada. It is rather difficult to give the reason why a type of thinking, which has been shown to be inadequate to meet the needs of modern life, should have maintained itself so long. One cannot altogether ascribe it to the individualism engendered by the effort to subdue a new half continent to civilization, for with a task somewhat similar and an even sparser population quite a different course of development has been seen in Australia and New Zealand. In fact among all the advanced nations comprising western civilization, there seems to be no doubt that from the standpoint of social legislation and general social organization, Canada stands last. There is no nation with a more deep seated instinct of kindliness, no nation more generous to individual needs, but the "community spirit", the "consciousness of kind", the "social consciousness" or whatever one wishes to call it, has been until recently largely absent.

But let us emphasize that expression "until recently". The mental outlook of Canada has changed with startling rapidity. There has been

tremendous pressure upon Canada during the last four years and pressure results in cohesion. It is difficult to realize how marked has been this change in sentiment. To-day the bars are all down. Questions which were purely academic five years ago or less, have suddenly swung into the field of practical politics. The present attitude of legislators is open and hospitable to practical suggestions. There is a large amount of leeway to make up, but the conditions of rapid advance are now present. The next ten years will be most creative ones for Canada, and will almost inevitably result in the formulation of a great code of social legislation.

The need of to-day is a two-fold one. In the first place there is the need of more definite co-operation among different bodies and individuals who are seeking to secure the same social ends. That cynical saying attributed to a member of a Cabinet "that it doesn't matter much what we say, but we must all say the same thing", has its lesson for to-day. It does matter a great deal what we say and it also matters enormously that there should be a fair amount of agreement, at least upon essentials. Agreement is impossible except by definite co-operation. If the large number of forces in Canada which are working for an enlarged measure of general health, economic opportunity, culture and education, unite they are irresistible. There is still greed to be fought and inertia to be overcome. A united front is one of the first requisites of success. The conditions are favourable, but stupidity, narrowness and jealousy could do a great deal to delay or defeat success.

The second great need is for a close comparative study of the social legislation of other countries and the framing of definite bills which will adapt the best and most successful measures of other countries to the conditions prevailing in Canada. There is great danger of ill-digested pieces of legislation, which will possibly do something to discredit the whole movement or in any case will stand in continual need of revision and amendment. Social legislation must stand on a sound scientific basis. There is need for more than goodwill, although that is very important. Goodwill must be directed by a trained scientific intelligence.

We must still have our conventions to inspire and crystallize public opinion, but even more important just now are those smaller group meetings in which definite bills can be hammered out and presented as suggestions to legislatures. There is a good deal of prominence given just now to the question of mothers' allowances, and a large number of resolutions have been forwarded to the Government from isolated bodies who favour this. But what kind of a bill do we want? What classes are to benefit by the bill? Are the mothers of illegitimate children or those whose husbands suffer from physical disability to come within its scope? How is the act to be administered? Is it to be detailed or

general, giving large powers to a commission? What is the probable cost of such an act to the province? And what proportion of the expense is to be met by the provincial and municipal authorities respectively? These are some of the questions which ought to be settled and is here mentioned only as suggestive of the type of thing which must be done in connection with each specific piece of social legislation.

Canada is learning through the "fellowship of suffering" to regard the needs of each as the concern of all. There is a heavy responsibility resting upon the social leaders of to-day, to see that this has fitting expression in a sane and well ordered national development.

The Provincial Board of Health of Ontario

JOHN W. S. MCCULLOUGH, M.D., D.P.H., Chief Officer of Health.

The Venereal Disease Prevention Act of Ontario, Canada

THE following is a synopsis of an Act recently passed by the Legislature of the Province of Ontario with the purpose of controlling venereal diseases.

The Act provides that any person under arrest may, if the medical officer of health believes that the person is infected with venereal disease, be required to undergo an examination in order to ascertain if he is, or is not, infected with this disease, which by the Act includes gonorrhœa syphilis and chancroid. If the person so examined is found to be infected he may be detained and treated. Physicians in medical charge of gaols and other places of detention are required to report within twenty-four hours, any persons confined who may be found to be infected.

If a medical officer of health has credible information that any person is suffering from venereal disease the officer may require such person to be examined and if the person is infected the officer may take steps requiring satisfactory treatment.

In order to prevent unjust action against a physician who makes an examination or report in respect to such cases, it is provided that such action can only be brought with the consent of the Provincial Board of Health.

Provision is made for right of entry to a house or premises by the medical officer of health or his deputy in the daytime for the purpose or enquiry or examination in respect to such cases. This provision is identical with the one in force in respect to other communicable diseases.

Hospitals designated by the board are required to provide facilities for treatment

No one but a legally qualified physician is allowed to attend upon or prescribe for or supply or offer to supply any drug, medicine appliance or treatment to or for a person suffering from venereal disease or for the purpose of the alleviation or cure of such disease; the only exception to

this being that a qualified chemist may fill the prescription of a physician for such purposes. The penalty for infringement of this provision is $100 to $500. A similar penalty is provided against advertising in a newspaper, pamphlet or other periodical, any remedy or cure for these diseases. This penalty is also provided for anyone knowingly infecting any person with venereal disease.

Anyone making statements to the effect that a person has one or other of these diseases except in case of disclosures made in good faith to a medical officer of health or physician in consultation is liable to a penalty of $200.

Provision is made with the object of maintaining secrecy in respect to cases of this nature by those who have the administration of the Act.

The most important feature of the Bill lies, however, in the powers given the Provincial Board to make Regulations in regard to the *forms* and *notices* to be used in the administration of the Act, the *remedies* to be used, the *course* of *conduct* of the patient, the *distribution of information* concerning these diseases, the *regulation of treatment* in hospitals, etc., *preventing* infection, *reporting of cases* by serial number, *notices* and *placards* in public places, *imposing penalties* for infringement of regulations, *procedure* in appeals which may be made as a finalty to the board and the *method and extent of examination* of persons.

The board is given power to manufacture and distribute remedies free or otherwise to local boards of health, physicians, and hospitals.

Any expense in carrying out the provisions of the act may be incurred by the medical officer of health or local board, and such expense must be met by the municipality. The Regulations under the Act are now in course of preparation and the law goes into effect on the 1st of July, 1918.

While the effect of this law, which is a fairly drastic one, can scarcely be foreseen, it is reasonable to regard it as a decided step in advance. The restriction of practice in these diseases to qualified physicians and the prohibition of the advertising of quack remedies will, it is hoped, do much to eliminate the baneful effects of treatment by druggists and quacks, who not only do no good, but usually do a lasting injury to the victims of these diseases, not only by leaving them uncured, but in addition, by giving them a false sense of security, which allows of the transmission of disease to innocent parties. Reporting of the names of those infected, which does not seem to have worked well in practice elsewhere is not sanctioned by the Act, but reporting by number is required.

Bill

AN ACT FOR THE PREVENTION OF VENEREAL DISEASE.

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. This Act may be cited as "*The Venereal Diseases Prevention Act.*"

2. In this Act,

(*a*) "Board" shall mean Provincial Board of Health;

(*b*) "Local Board" shall mean Local Board of Health;

(*c*) "Prescribed" shall mean prescribed by this Act or by the Regulations;

(*d*) "Regulations" shall mean regulations made under the authority of this Act or *The Public Health Act;*

(*e*) "Venereal disease" shall mean and include syphilis, gonorrhœa and chancroid.

3.—(1) Whenever any person is under arrest or in custody charged with an offence against The Criminal Code of Canada or against any Statute of Ontario or any by-law, regulation or order made under the authority thereof, or has been committed to a gaol, reformatory or other place of detention upon conviction of such offence, and the medical officer of health for the municipality or district believes that such person is, or may be, infected with, or has been exposed to infection from venereal disease, the medical officer of health may cause such person to undergo such physical examination as may be necessary, or as may be prescribed by the regulations, in order to ascertain whether or not such person is infected with venereal disease.

(2) If, upon such examination it is found that the person examined is so infected the medical officer of health shall give such directions for the treatment of the patient and, if necessary, for his detention and isolation and the prevention of infection from him as may be deemed proper and as may be authorized by the regulations, and he is hereby empowered to do and authorize any act necessary to effect the carrying out of such treatment, detention, isolation and prevention, and it shall be the duty of every such patient to carry out such directions as to treatment and of every constable, gaoler, warden, superintendent and officer having the care and custody of any infected person in any place of detention or in any hospital to see that the directions of the medical officer of health are duly carried out.

(3) It shall be the duty of every physician in medical charge of any gaol or place of detention or of the inmates thereof to report to the

medical officer of health the name and place of detention whether before or after conviction of any person, whether included in the class mentioned in the preceding subsections or not, whom he suspects or believes to be suffering from venereal disease, such report to be made within twenty-four hours after the time of arrival of such person in the gaol or place of detention.

4.—(1) Subject to the regulations, where the medical officer of health is credibly informed that a person resident in the municipality or district for which the medical officer of health is appointed is infected with venereal disease and has infected or is liable to infect other persons, the medical officer of health may give notice in writing to such person requiring him to consult a legally qualified medical practitioner and to produce to the medical officer of health within a time to be specified in the notice a report or certificate of such medical practitioner that the person so notified is or is not suffering from venereal disease.

(2) If such certificate is not produced within the time stated in the notice, the medical officer of health may, by writing signed by him authorize any legally qualified medical practitioner to examine such person and report or certify as to whether he is or is not suffering from venereal disease.

(3) If by the report of certificate mentioned in either of the two preceding subsections it appears that the person so notified is suffering from venereal disease the medical officer of health may exercise the powers and duties as vested in him by subsection 2 of section 3 to such extent as he may deem necessary in the public interest or to the full extent therein provided.

(4) If the person so notified produces a report or certificate from a legally qualified medical practitioner in the prescribed form stating that such person is suffering from venereal disease or if the report or certificate under subsection 2 of this section is to the same effect the medical officer of health may, in place of proceedings under the preceding subsection, deliver to such person and to the legally qualified medical practitioner signing the said report or certificate directions in the prescribed form as to the course of conduct to be pursued by such person and may require him to produce from time to time such evidence as may be deemed advisable that such person is undergoing proper medical treatment and is in other respects carrying out such directions, but in case such person fails to comply with the course of conduct prescribed for him and to produce the evidence hereinbefore referred to the medical officer of health may, as to such person, exercise any or all of the powers vested in him by subsection 2 of section 3.

(5) No action or other proceeding shall be brought against any legally qualified medical practitioner in respect of any examination,

report or certificate made or given by him under the provisions of this Act, unless and until the consent, in writing, of the board to such action or other proceeding has been given, signed by the chairman and secretary of the board.

(6) The medical officer of health, or a legally qualified medical practitioner appointed by him in writing for that purpose, may enter in and upon any house, outhouse or premises, in the day time, for the purpose of making enquiry and examination with respect to the state of health of any person therein and may cause any person found therein who is infected with any venereal disease to be removed to a hospital or some other proper place, or may give such directions as may prevent others being infected in the said house, outhouse or premises.

(7) The powers and duties of this section conferred or imposed upon the medical officer of health, may be exercised and performed by the Board in any case in which the Board deems such action expedient.

5.—(1) Every hospital receiving aid from *Ontario* under *The Hospitals and Charitable Institutions Act* shall make effective provision for the examination and treatment, upon such terms as may be prescribed of such persons or classes of persons suffering from venereal disease as may by the regulations be declared fit to be treated at such hospital, and in case of default the Treasurer of Ontario may withhold from any hospital the whole or any part of such grant which would otherwise be payable.

(2) The Lieutenant-Governor in Council shall have power to designate any hospital or other public institution or portion of any such hospital or institution under its jurisdiction or any house or building as a hospital or place of detention or isolation for the reception and treatment of any person suffering from venereal disease.

6.—(1) No person other than a legally qualified medical practitioner shall attend upon or prescribe for or supply or offer to supply any drug, medicine, appliance or treatment to or for a person suffering from venereal disease for the purpose of the alleviation or cure of such disease.

(2) Every person guilty of a contravention of subsection 1 shall incur a penalty of not less than $100 and not more than $500.

(3) Subsection 1 of this section shall not apply to a registered pharmaceutical chemist who dispenses to a patient of a legally qualified medical practitioner the prescription of such practitioner or who sells to any person any patent or proprietary or other medicine, drug or appliance approved of by the regulations for the cure or alleviation of venereal disease.

7.—(1) Every person who

(*a*) publishes or causes or allows to be published in a newspaper or magazine or other periodical publication any notice, advertisement, statement, testimonial, letter or other matter;

(*b*) issues or publishes or causes to be issued or published any book, almanac, pamphlet, fly-sheet, document or other matter;

(*c*) posts up or exhibits in any place so as to be visible to persons being in or passing along any street, highway, railway or public place, any notice, statement, advertisement, testimonial, letter or other matter;

(*d*) distributes, circulates or delivers or sends by post to any person any pamphlet, circular notice, statement, advertisement, testimonial, letter or other matter, intended to recommend or suggest the purchase of or to promote the sale of any article as a drug, medicine, appliance or instrument or as part of any treatment for the alleviation or cure of any venereal disease or of any disease or affection of the genito urinary organs or intended to convey an offer to give or prescribe any form of treatment for any of the aforesaid diseases, shall incur a penalty of not less than $100 nor more than $500, and in default of immediate payment thereof shall be imprisoned for a period not exceeding twelve months.

(2) Subsection 1 of this section shall not apply to any such article which has been approved by regulations nor to books, documents and papers or other matter published in good faith for the advancement of medical or surgical science.

(3) Before any proceedings are taken under this section against any newspaper proprietor, printer or publisher for printing or publishing or allowing to be published any notice, advertisement, statement, testimonial, letter or other matter in a newspaper the Board shall notify the proprietor, printer or publisher that the publication complained of is an infringement of this Act, and he shall not be liable to prosecution except in respect of an offence of the same or a similar nature after such notification.

(4) Any of the matters or things prohibited by this section may be restrained by injunction or order in an action in a county or district court having local jurisdiction or in the Supreme Court of Ontario, but such proceedings shall not prevent, delay or in any way be a bar to any prosecution or other proceedings authorized by this Act.

8. Every person who, knowing or having reason to believe that he is or may be infected with venereal disease, does or suffers any act which leads or is likely to lead to the infection of any other person with such disease shall incur a penalty of not less than $100, nor more than $500, and in default of immediate payment thereof shall be imprisoned for a period not exceeding twelve months.

9. Every person who

(*a*) contravenes any provision of this Act or of the regulations for which no other penalty is provided by this Act;

(*b*) wilfully neglects or disobeys any order or direction lawfully given by a medical officer of health or by the Board or a local board under this Act or the regulations;

(*c*) hinders, delays or obstructs any officer in the performance of his duties under this Act, or

(*d*) without lawful authority publishes or discloses any proceedings taken under this Act or the regulations;

shall, where no other penalty or proceedings are prescribed or authorized incur a penalty of not less than *$25* nor more than $100, and in default of immediate payment shall be imprisoned for a period not exceeding three months.

10.—(1) Every person who, publicly or privately, verbally or in writing, directly or indirectly, states or intimates that any other person has been notified or examined or otherwise dealt with under the provisions of this Act, whether such statement or intimation is or is not true, in addition to any other penalty or liability, shall incur a penalty of $200, and in default of immediate payment shall be imprisoned for a period of not more than three months.

(2) Subsection 1 shall not apply to disclosures made in good faith to a medical officer of health for his information in carrying out the provisions of this Act, not to any communication or disclosures made to a legally qualified medical practitioner or in the course of consultation for treatment for venereal disease, nor to any communication authorized or required to be made by this Act or the regulations.

11. *The Ontario Summary Convictions Act* shall apply to prosecutions under this Act or the regulations, but all proceedings for the recovery of penalties under this Act, except those authorized by section 7, shall be conducted in camera and no report of such proceedings shall be published in any newspaper.

12. Every person employed in the administration of this Act shall preserve secrecy with regard to all matters which may come to his knowledge in the course of such employment, and shall not communicate any such matter to any other person except in the performance of his duties under this Act, and in default he shall in addition to any other penalty, forfeit his office or be dismissed from his employment.

13.—(1) The Board, subject to the approval of the Lieutenant-Governor in Council, may make regulations:

(*a*) prescribing the forms of notices and certificates to be given or issued under this Act;

(*b*) declaring what shall be deemed to be lawful and proper methods and remedies for the treatment, alleviation and cure of venereal disease, and requiring all advertisements, statements, testimonials, letters or other matters of or regarding such methods and

remedies to state the date and number of the official approval of the same and such other information as may be deemed desirable;

(*c*) prescribing the course of conduct to be pursued by any person infected with venereal disease in order to effect a cure and to prevent the infection of other persons;

(*d*) for distributing to medical practitioners and hospitals such information as to the treatment, diet, and care of persons suffering from venereal disease and may require medical practitioners and hospitals to distribute the same to such persons.

(*e*) prescribing rules for the treatment of such persons in hospitals, places of detention and other institutions;

(*f*) for preventing the spread of infection from persons suffering from venereal disease;

(*g*) requiring medical practitioners, hospital superintendents and heads of places of detention and public institutions to make reports upon the cases of venereal disease coming under their treatment or care but, except where it is otherwise in this Act, without disclosing the name or address of any person suffering from venereal disease, and prescribing the form of such reports;

(*h*) providing for the putting up of notices and placards dealing with venereal disease, its cause, manifestation, treatment and cure in all public urinals and conveniences and similar places;

(*i*) providing for public advertising and placarding of such information relative to the treatment and cure of venereal disease and the places where proper remedies can be obtained as may seem desirable;

(*j*) imposing penalties for the violation of any provision of this Act or anything covered by this Act or any regulation;

(*k*) generally for the better carrying out of the provisions of this Act and for the prevention, treatment and cure of venereal disease;

(*l*) prescribing the procedure to be adopted and the evidence to be required in case of an appeal to the Board from any action or decision of a medical officer of health under this Act;

(*m*) providing for the procedure relative to detention for the purpose of examination or cure or the prevention of infection, so as not to interfere with the course of justice in case of persons under arrest or in custody previous to trial for any offence committed against the provisions of this Act or anything therein authorized or under any other Statute or the Criminal Code.

(*n*) prescribing the method and extent of the examination of any person with a view to ascertaining whether or not such person is infected with venereal disease.

(2) The Board, with the approval of the Lieutenant-Governor in Council may, out of any moneys appropriated by the Legislature for the purposes of the Board, provide for the manufacture and free distribution to local boards and to medical practitioners and hospitals of any drug, medicine, appliance or instruments which the Board may deem useful or necessary for the alleviation, treatment or cure of venereal disease or the prevention of infection therefrom.

14.—(1) The treasurer of the municipality shall forthwith, upon demand, pay the amount of any account for services performed therein under the direction of the local board and for materials and supplies furnished, or for any expenditure incurred by the local board or by the medical officer of health in carrying out the provisions of this Act, or the regulations, after the local board has by resolution, approved of the account and a copy of the resolution certified by the chairman and secretary has been filed in the office of the treasurer.

(2) The corporation of the municipality shall be entitled to recover the amount expended in providing such medical attendance, medicine, nurses and other assistance and necessaries for any person having any venereal disease from such person, but not the expenditure incurred in providing a separate house or in otherwise isolating him except where such isolation is provided in an hospital or other place designated as such under this Act.

15.—(1) Every person who deems himself aggrieved by any action or decision of a medical officer of health under this Act may appeal therefrom to the Board by giving notice in writing to the Board and to the medical officer of health.

(2) The Board may require the appellant to furnish such information and evidence and to submit to such examination as may be prescribed or as the Board may deem necessary to determine the matter in dispute.

(3) The decision of the Board shall be final.

16. This Act shall come into force and take effect on the 1st day of July, A.D. 1918.

Cases and Deaths from Communicable Diseases

Reported by the Local Boards of Health for the Month of April, 1918.

The prevalence of SCARLET FEVER in the Province for the last four months continues much the same for April. The disease appears to be of a mild type compared with the epidemic we had in the early part of 1903, when the outbreak was of a very virulent type causing as many as 104 deaths in one month. During the first four months of that year we had 1,860 cases and 350 deaths, an average of 465 cases and 87 deaths monthly, making the highest death rate in the Province for thirty years—18.8 in 100. For the corresponding four months of 1918 there were 1,416 cases and 36 deaths, or a death rate of 2.5 in 100.

DIPHTHERIA has dropped from 394 cases and 32 deaths in January last to 249 cases and 22 deaths in April. The Provincial Board of Health distributed for the month 8,559,000 units of antitoxin free to the localities where the disease existed at a cost of $1,280.00.

SMALLPOX shows a material reduction for April, compared with the former three months, when we had reported for January 79 cases; February 91; March 47; and April 39. The places reporting the disease are: Toronto, Windsor, Chatham, Wyoming, Raleigh, Romney, Stisted and Waters one case each; Ottawa and Sarnia two cases each; Belleville, Hawkesbury, Dresden and Worthington three cases each; Sandwich five cases; and St. Thomas and Rochester Township seven cases each. For the first four months of this year we had 256 cases and one death as compared with 40 cases for the corresponding months of 1917.

MEASLES prevailed to a much greater extent, there being 1,461 cases and 11 deaths as against 842 cases and 5 deaths in April last year.

WHOOPING COUGH also increased from 76 cases to 240.

The Comparative Table will show the increase and decrease for the other diseases:

COMPARATIVE TABLE for the Month of April, 1918.

	1918		1917	
Diseases.	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*
Smallpox	39	0	12	0
Scarlet Fever	383	16	193	3
Diphtheria	249	22	223	20
Measles	1461	11	842	5
Whooping Cough	240	4	76	2
Typhoid Fever	38	5	36	6
Tuberculosis	187	122	165	96
Infantile Paralysis	2	1	1	0
Cerebro Spinal Meningitis	17	12	15	9
	2616	193	1563	141

COMPARATIVE TABLE for First Four Months of 1918.

	1918		1917	
Diseases.	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*
Smallpox	256	1	40	0
Scarlet Fever	1416	36	769	3
Diphtheria	1279	95	1225	88
Measles	4591	45	4957	15
Whooping Cough	1061	20	447	13
Typhoid Fever	124	19	156	28
Tuberculosis	606	325	588	354
Infantile paralysis	7	3	6	0
Cerebro-spinal meningitis	53	35	58	39
	9393	579	8246	540

Editorials

Business and Public Health

ONE cannot help but be impressed with the fact that generally speaking the ideals of business and those of public health are antagonistic and that this obvious fact is fraught with serious consequences. The ideal of the sincere public health worker is to see that the health of the average individual in the community is maintained at the highest possible level. The ideal of the sincere business man sincere to business ideals alone may be epitomized by the economic axiom of "buy in the cheapest market and sell in the dearest" with "caveat emptor" thrown in as good measure.

Such ideals are so unmoral that they are largely nimical to the public interest. It is argued that by stimulating individual competition they result in magnified production of all sorts but such a conclusion is very questionable. Everyone does know, however, the extremely dangerous results of the passion for wealth which is the country's greatest curse. Miserable housing conditions because landlords squeeze out the last cent from their poor tenants, inadequate wages followed by all the pathetic results of poverty, poor educational standards, creature comforts for the few instead of the many, unhygienic industrial surroundings, the greed of the patent medicine manufacturer with its serious results not only in wasted money but neglected disease—all are the result of a false point of view.

The biggest business of the country is not to humour its profiteers but to change their attitude. Citizenship in the biggest sense of the word, not selfship, should be brought to the front as an ideal. Each man, woman and child in the country should be taught the truth—that the greatest accomplishment is not to get but to give—that the contribution of energy, enthusiasm and ability to the welfare of the community will in the long run bring in the greatest return to everyone including the contributor. Such ideals installed in the minds of the people would do so much both for the physical and mental welfare of the individual and the stability of the State that in a brief generation we would indeed be a nation transformed.

The Training Camp Activities Commission

The inclusion of the Ontario Bill for the Prevention of Venereal Disease in the present number of THE PUBLIC HEALTH JOURNAL brings to mind certain constructive phases of preventive work which have not yet been sufficiently investigated in Canada. Work of the character suggested is being carried on by the Training Camp Activities Commission in the United States and might well be undertaken in our own country.

Any programme for the control of venereal disease should of course include a very energetic attack on prostitution. Under the Training Camp Activities Commission such an attack is being undertaken—and successfully. If prostitution—an abnormal mode of living—is to be done away with it must entail a realization of the fact that normal life must not only be made possible but easy of attainment for the average young man and woman. The Training Camp Activities Commission attempts to meet this need by their endeavour to stimulate and co-ordinate the activities of the Y.M.C.A., Y.W.C.A., American Playgrounds Association and other organizations in order that they may do what they can to make life happy and normal particularly for the American soldier and the young women whom he should meet only under normal surroundings. Such work has already done a great deal to make the people of the United States think about their young people and it is hoped that in an early issue of THE PUBLIC HEALTH JOURNAL it will be possible to describe at least some of it. Were it to succeed only in remodelling the warped point of view from which we have suffered in the past it would justify itself. We must learn that democracy to be useful must be not only a word but a fact—that it must mean a square deal for everyone—not only theoretically but actually—and the best way to attain that end is not by a Bolsheviki uprising but by training the people in the organized application of the golden rule.

The Training Camp Activities Commission is, it seems, fulfilling exactly that function. Community work organized on an enormous scale all over America is nominally for the welfare of the soldier. With the avowed intention of stamping out that great enemy to army efficiency venereal disease, it is resulting in measures of far-reaching social significance.

Ultimately we will discover that if such work is necessary to the health and wellbeing of armies it is essential to the efficiency of nations and after the war it will be greatly extended among civilians. Our armies are engaged in "making the world safe for democracy". It is none the less the duty of those of us at home to see that when our armies have returned we shall have done our part by steady community endeavour to "make democracy safe for the world".

Toronto's Health Department

On May 6th a large deputation waited upon the City Council of Toronto with the request that the sum of $22,000 be restored to Dr. Hastings estimates for the Department of Health and that the Health Bulletin which had been discontinued as a so-called war economy be published again. The deputation represented many of the largest and most influential organizations in Toronto and its spokesmen voiced in no uncertain way a very general public opinion that tampering with the machinery of efficient health departments will in future be looked upon by the electors with great suspicion and apprehension.

It is unnecessary to summarize Dr. Hastings' work here, most public health workers are already fully informed on the subject. The fact that the death rate in all of the communicable diseases, as well as the general death rate, has fallen steadily and remarkably since he took office is sufficient proof of the efficiency of his department. The trouble is that our civic legislators never seem to get it into their heads that to obtain a healthy community we have to pay out real money. They slash even important parts of health department estimates with as little consideration as though they were estimates for the purchase of window blinds or fountain pen fillers and forget that perhaps life is a little more important than most of our material possessions

As for Controller McBride—a gentleman whose greatest pleasure seems to lie in making unwarranted charges against the Health Department—one can only hope that at the annual elections public opinion will express its censure adequately.

Book Reviews

Household Management, by FLORENCE NESBITT, Director of the Food Conservation Section of the Cleveland Women's Committee of the Council of National Defense. Cloth, 172 pages. Russell Sage Foundation, New York. Price 75 cents.

In the task ahead of us of producing and using foodstuffs so as best to conserve health and materials, this country needs the help of the humblest householders. But how is that help to be enlisted? Everyone who goes in and out of small income homes on any social service errand can repeat the message. It must be clearly prepared, however, in advance. Florence Nesbitt does this very thing with telling force and a wealth of practical illustrations in a small book of attractive appearance entitled Household Management, just issued by the Russell Sage Foundation. This is the second volume in their new Social Work Series, edited by Mary E. Richmond.

There are many books on the general subject of homemaking, but none like this one, which is written from intimate knowledge of the drawbacks and inconveniences of housekeeping in cramped quarters and with cramped means. Those who are far removed from dependence can take this little volume's lessons to heart, but to the social worker, the Red Cross visitor, the public health nurse, or any volunteer visitor in city neighbourhoods, it will be indispensable. The book describes each definite step by which the city dweller with little income and many children can get the most for his money. It is democratic and human. Its pages grip the attention by their many stories of real people, briefly told.

With all this appeal to every-day experience, Miss Nesbitt is a trained household economist. She is at present director of the food conservation section in Cleveland, and home demonstration agent of Ohio State University. Before this she was dietitian of the mothers' pension department of the Chicago Juvenile Court. It was while working in this capacity that she became impressed with the fact that the women who needed food demonstration the most were the very ones who remained outside such present day activities, unless approached understandingly one by one. When thus sought out, they are found to be eager to learn and eager to apply their new knowledge.